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LEAD IN THE SINO-SOVIET BLOC

CIA/RR ER 61-31

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CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

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LEAD IN THE SINO-SOVIET BLOC*

Summary and Conclusions

The Sino-Soviet Bloc** has registered sizable annual increases in production of primary lead,*** and its share of the world output of lead has increased steadily since the end of World War II. Output of 567,000 metric tons† in 1960 was about 12 times more than the Bloc produced in 1945, and in the same period the Bloc's share of the world output grew from less than 5 percent of the total to about 25 percent.

Within the Bloc the largest producer has been the USSR, which accounted for about 55 percent of the Bloc's output in 1960. Since 1957, Communist China has been the second largest producer, accounting for slightly more than 19 percent of the Bloc's output in 1960. In the same year, Bulgaria and Poland accounted for 7 percent and 6 percent, respectively, of the Bloc's output, and the remainder was produced by North Korea, Rumania, Czechoslovakia, East Germany, and Hungary, in that order.

By 1965, when the Bloc may produce about 820,000 tons of primary lead (almost 45 percent more than in 1960), its output could represent as much as 30 percent of the world total. Of this increase in production, each sector of the Bloc -- the USSR, the European Satellites, and the Asian Bloc†† -- is to account for about one-third. The USSR will continue to be the dominant producer of lead in the Bloc, but its share probably will decline to about one-half of the total output.

Production of secondary lead in the Bloc at the present time is far less important than in highly industrialized countries of the Free World. Of the total production of refined lead in the Bloc, about 12 percent is derived from secondary metal, whereas in the rest of the world secondary production constitutes about one-third of the total output (in the US alone, about one-half). Although production of secondary

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 July 1961.

** The term Bloc as used in this report refers to the Sino-Soviet Bloc.

*** The term primary lead refers to virgin metal derived from ore as distinguished from secondary lead, which is metal recovered from scrap.

† Tonnages are given in metric tons throughout this report.

†† See II, C, p. 8, below.

lead in the Bloc probably will increase through 1965, it is not expected to become as significant a proportion of the total supply of lead in the Bloc as it is in the rest of the world.

The Bloc's reserves of lead-bearing materials, the reserves of secondary metal, and the level of technology for processing both primary and secondary materials into lead metal are sufficiently high to sustain a steady development of the industry. The ore reserves are estimated to contain about 40 million tons of lead, equaling the reserves of the rest of the world, but the quality of much of the ore is poor. Technologies are being developed, however, for the economic recovery of lead from such ore.

Since the end of World War II, consumption requirements for lead in the Bloc have grown from year to year in direct proportion to the growth in the supply available from increasing domestic production. The USSR is by far the largest single consumer in the Bloc and is followed by Communist China, East Germany, and Poland, in that order. The uses for lead in the Bloc are similar to those in the rest of the world. Batteries and cable covering comprise the major requirements, and the use in alloys and pigments also is significant.

The Bloc as a whole apparently did not achieve self-sufficiency in production of lead until 1960. In spite of the large increase in production since the end of World War II, only Bulgaria, Communist China, and North Korea have become self-sufficient. The imbalance of supply has resulted in a major program of intra-Bloc trade characterized by three major movements, as follows: (1) countries with insufficient smelting and refining capacity export ore and concentrate, (2) countries with excess refining capacity import ore and concentrate, and (3) countries with requirements in excess of domestic supply import lead metal. For example, in recent years, Bulgaria has supplied the USSR with concentrate (and in turn the USSR has supplied other European Satellites with a nearly comparable quantity of refined metal) at the same time that Communist China and North Korea have supplied the USSR with ore, concentrate, and some crude metal.

Through 1959 the Bloc was a net importer of lead from countries of the Free World, but the volume of trade conducted with these countries was small. Although the volume of such trade nearly tripled during 1955-59, growing from 15,500 tons to 43,200 tons, net imports declined steadily after 1956 and in 1959 amounted to only 3,300 tons. Preliminary data indicate that in 1960 the Bloc became a net exporter of lead for the first time. The chief country outside the Bloc with which trade is conducted is Yugoslavia, although some lead also moves between the Bloc and the industrialized countries of Western Europe and between the Bloc and certain underdeveloped countries such as Iran.

Several observations can be made on costs and prices in the lead industries of the USSR and East Germany. The lead industry of the USSR appears to have been self-supporting since 1955, when prices were raised sufficiently to cover costs. In spite of the seemingly favorable relationship of cost to price and a professed shortage of lead, the USSR has placed less emphasis on increasing production of lead during the Seven Year Plan (1959-65) than on production of other major nonferrous metals. A possible explanation for this relative lack of emphasis is the increasingly successful substitution of cheaper aluminum* and plastics. During the Seven Year Plan the substitution of aluminum for lead in the electronics industry is to save several hundred thousand tons of lead. In East Germany, on the other hand, the lead industry appears to be subsidized heavily, for the cost of production of a ton of lead is much higher than the price. High costs of production in East Germany reflect the low quality and the difficulty of mining the ore.

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* This situation is in contrast to that in the Free World, where lead is cheaper to produce than aluminum.

I. Introduction

Since the late 1940's, when the consumption requirements pent up during World War II by the restrictions imposed on nonmilitary uses had been satisfied, the Free World has produced more lead than it has consumed. Until 1957 the excess of supply over consumption requirements was absorbed, for the most part, by the stockpiling program of the US Government. Because production did not decrease after the program ended, supplies quickly accumulated on the market. As a result, prices of lead in both US and foreign markets declined rapidly. 1/*

In an effort to balance the supply and the consumption of lead, the UN Committee on Lead and Zinc, which later became the International Lead and Zinc Study Group, was established. 2/ With more than 20 countries cooperating, this organization has succeeded in restricting production of lead by several countries, but it has failed to eliminate the gap between supply and consumption. 3/ Moreover, prices remain low, and producers' stocks have been accumulating at a rather disturbing rate. In March 1961 the International Lead and Zinc Study Group expressed the hope that exports from the Bloc in 1961 would not exceed their level in 1960. 4/

The lead industry of the Bloc in recent years has been developing independently from that of the rest of the world. Cooperation among the members of the Bloc appears to be highly developed and probably is coordinated through the Council for Mutual Economic Assistance (CEMA), although directed primarily by the USSR. Technical aid to countries with less extensively developed lead industries, such as Communist China, Poland, Rumania, and Bulgaria, has been extended by the USSR with tangible and positive results.

II. Resources

Resources of lead in the Bloc are very large and are distributed widely. Every country of the Bloc except Albania is known to have deposits of lead. Although estimates by the Free World of reserves in the Bloc generally have been set at only about 4 million tons, fragmentary data from primary sources indicate total reserves of nearly 40 million tons. Lead reserves in the Free World also are estimated to be about 40 million tons. Reserves in the Free World, however, are measured or indicated, whereas those in the Bloc also include "inferred" and possibly even undiscovered reserves as well as deposits that would

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not be economically recoverable in the Free World.* Lead reserves claimed or estimated for selected countries of the Bloc and of the Free World are as follows:

Country	Million Tons
USSR	13.0
Communist China	11.5
Australia	11.3**
East Germany	8.7***
Canada	7.3**
Bulgaria	4.6†
Mexico	3.2**
US	2.6**
Other countries of the Free World	13.6††

Lead reserves in the Bloc, which consist primarily of polymetallic ore deposits, vary markedly in quality. At present, Communist China, North Korea, and Bulgaria possess the highest quality of ores in terms of metal content. Throughout the Bloc the average metal content of ores mined has declined, but installation of automated equipment, mechanization of some processes, and more efficient processing techniques have minimized the costs of exploiting lower grades of ore.

A. USSR

1. Ore

The USSR claims to occupy first place in the world in explored lead reserves. 8/ Although official figures have not been released since 1936, total reserves, consisting for the most part of polymetallic sulfide ores, are estimated to have been about 13 million tons in 1960. The quantity of proved reserves is being increased as a result of the exploration program under the Seven Year Plan (1959-65), but the quality of newly discovered reserves is lower than that of

* The terms measured and indicated refer to ore reserves the extent of which is established by mathematical calculations based on geologic evidence. The term inferred refers to estimates based only on the geologic character of the deposits.
** 5/
*** 6/
† 7/
†† Residual.

reserves previously known. In 1957 the average content of lead in reserves ranged roughly between 1.6 and 5.5 percent, 9/ a metal content generally below that of the reserves in major lead mining countries of the Free World.* 10/

Most of the lead reserves of the USSR are located in Kazakh SSR, the Central Asian republics,** the Far East, East Siberia, and the Caucasus. 11/ Kazakh SSR, which possesses about 62 percent of the total Soviet reserves, 12/ includes three major areas of lead deposits. At present, nearly one-half of the identified reserves in the republic are in Vostochno-Kazakhstanskaya Oblast, 13/ but during the Seven Year Plan the increasing quantity of identified reserves in Central Kazakhstan (mainly in Karagandinskaya Oblast) is expected to rival that in Vostochno-Kazakhstanskaya Oblast. 14/ In addition, the Mirgalimsay deposit in Yuzhno-Kazakhstanskaya Oblast contained 15 percent of the total Soviet lead reserves in 1958. 15/

Some proved reserves are too inaccessible for efficient commercial exploitation. The location of almost one-half of the reserves of the Leninogorsk ore field in Vostochno-Kazakhstanskaya Oblast at great depths below a river bed has made exploitation difficult and has restricted development of the Leninogorsk Polymetallic Combine. 16/ The rugged mountain terrain in the Central Asian republics also hampers exploitation of the Altyn-Topkan group of deposits. 17/

2. Scrap

Resources of secondary lead in the USSR are growing concomitantly with increases in production and consumption of lead metal. In the USSR, secondary lead is classified as old (amortized) and new (plant, or runaround) scrap. In recent years, old scrap, mainly from the motor transport and electrical cable industries, has constituted about three-fourths of the total scrap recovered. 18/ The breakdown by source of scrap procurement in the USSR in 1954 is as follows 19/:

	Percent of Total
Old scrap	76.9
Battery	36.9
Other apparatus and equipment	17.5
Cable covering	14.5
Babbitt	6.9
Calcium babbitt	2.9
Lead-tin babbitt	4.0
Military (including "shrapnel" and bullets)	1.1
New scrap (including shavings, slime, dross, and slag)	23.1
Total	100.0

* For additional information on major deposits in the USSR, see Appendix A.

** The term Central Asian republics as used throughout this report refers to Kirgiz, Tadzhik, Turkmen, and Uzbek SSR's.

B. European Satellites

Quantitative measurements of lead reserves in the European Satellites are not generally available, but reserves are believed to be small in all countries except East Germany and Bulgaria. In 1952, East German lead reserves were estimated to be about 8.7 million tons, much of which, however, was classified as "inferred."* 20/ Bulgaria has sizable lead reserves amounting in 1959 to 4.6 million tons, a quantity sufficient for many years at the present rate of mining. 21/

Lead reserves consist for the most part of deposits of low-grade polymetallic sulfide ores in which lead is found in association with various combinations of zinc, sulfur, copper, gold, silver, and other elements. With continued exploitation the better grades of reserves throughout the Satellites have been depleted. Bulgaria now possesses the best reserves in terms of metal content, but the average lead content of Bulgarian ores mined in 1958 was only 3.6 percent compared with 10.8 percent in 1950. 22/ Lead deposits in East Germany have been exploited for hundreds of years, and many of the mines had been abandoned before World War II. The remaining complex ores are of very low grade, the average lead content of ores mined ranging from 2 to 2.5 percent. 23/ Known reserves of sulfide ores in Poland are rapidly nearing depletion, and oxide ores, formerly dumped because they are generally more difficult to process, are receiving attention. The average lead content of ores mined in Poland was only 1.95 percent in 1950 and is believed to have declined to 1.4 percent in 1960. 24/ Lead reserves in Czechoslovakia, Rumania, and Hungary are of a similar low quality.

All of the European Satellites except Albania possess known lead reserves. In East Germany, most of the reserves are located in the vicinity of the ancient mining town of Freiberg. Almost 40 percent of Bulgarian reserves are found near Kremikovtsi in the Balkan Mountains north of Sofia, 25/ and the remainder is scattered in a number of deposits in the eastern Rhodope Mountains. Small deposits are located northeast of Budapest in the Matra Mountains of Hungary, around Katowice in Poland, and near Herja and Ruschita in northwestern and western Rumania.**

C. Asian Bloc***

Resources of lead in the Asian Bloc are vast. Communist China claims to be second in the world in lead reserves, 26/ which are

* See the first footnote on p. 6, above.

** For additional information on major deposits in the European Satellites, see Appendix A.

*** For the purposes of this report the term Asian Bloc refers to Communist China and North Korea. North Vietnam, the third member of the Asian Bloc, produces no lead and possesses only small deposits of lead-bearing ore.

estimated to be 11.5 million tons. These reserves, however, presumably include many recently discovered deposits, and some of them after more detailed examination may prove to be unexploitable. No data are available concerning the lead reserves in North Korea, but the quantity must be large in view of the volume of ore mines, the large number of mines operating, and the expansion of operations planned.

As in the remainder of the Bloc, lead reserves of the Asian Bloc consist mainly of deposits of polymetallic sulfide ores. In China the lead content of these ores reportedly averages about 4 percent. 27/ In North Korea, where both sulfide and oxide ores are exploited, the average lead content of sulfide ores produced at 11 major mines between 1945 and 1950 ranged from 2 to 8 percent, 28/ whereas the lead content of oxide ores may be about 10 to 12 percent.

Almost every province of Communist China and North Korea is known to contain deposits of lead ore. Historically, Manchuria possessed the most important reserves in China, 29/ but at present deposits in Yunnan, Hunan, Tsinghai, Kwangsi, and Szechwan Provinces are believed to contain the best ores. In addition, Kansu, Hopeh, Kweichow, Kiangsi, Kwangtung, and Sinkiang Provinces are reported to have large and rich deposits. North Korea, which may be considered to be a single large mineralized region, has no marked concentration of lead reserves.*

III. Production

A. Primary

During 1950-60 the Bloc achieved striking increases in production of lead metal both in quantity and in relation to the world output. In 1950 the Bloc produced only 161,000 tons, or about 9.5 percent of the world total of about 1.7 million tons, 30/ but in 1960 the Bloc output of 567,000 tons constituted about 25 percent of the world production of about 2.3 million tons,** 31/ as shown in the chart, Figure 1.*** By 1965 the planned Bloc output of about 820,000 tons probably will range between 25 and 30 percent of the world production. The estimated production of primary refined lead in the Bloc for 1950, 1954-60, and 1965 is given in Table 1.† For comparison, the estimated mine output of lead for 1954-59 is given in Table 2.††

Although the USSR produces more lead than any other country in the Bloc, its relative contribution to the total production of the Bloc has declined noticeably. The percentage of the total output of primary

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* For additional information on the most important individual mines in the Asian Bloc, see Appendix A.

** Estimate based on preliminary data.

*** Following p. 10.

† Table 1 follows on p. 10.

†† Table 2 follows on p. 10.

refined metal in the Bloc provided by the USSR, which had been about 73 percent as late as 1955, declined to about 55 percent in 1960. In spite of an increase in production of lead estimated at about 90,000 tons during the remainder of the Seven Year Plan (1959-65), the USSR probably will contribute only about 49 percent of the production of the Bloc in 1965. As a result of large relative increases in production since 1950, Bulgaria, Communist China, and North Korea now account for a much greater proportion of the total production in the Bloc.

Table 1

Estimated Production of Primary Refined Lead in the Sino-Soviet Bloc
1950, 1954-60, and 1965

Thousand Metric Tons

Year	USSR	European Satellites	Communist China and North Korea	Total
1950	112.0	46.0	2.8	160.8
1954	227.0	66.2	18.3	311.5
1955	258.0	69.3	25.4	352.7
1956	269.0	75.7	32.0	376.7
1957	277.0	91.5	48.0	416.5
1958	288.0	98.8	64.0	450.8
1959	294.0	107.8	93.0	494.8
1960	314.0	115.8	137.0	566.8
1965	404.0 a/	200.5	215.0	819.5

a. Planned.

Table 2

Estimated Mine Output of Lead in the Sino-Soviet Bloc a/
1954-59

Thousand Metric Tons

Year	USSR	European Satellites	Communist China and North Korea	Total
1954	164.1	101.4	41.6	307.1
1955	186.6	109.2	52.0	347.8
1956	202.2	116.2	52.4	370.8
1957	204.6	137.0	66.8	408.4
1958	216.1	145.0	82.1	443.2
1959	230.6	150.3	107.3	488.2

a. In terms of the estimated refined metal content.

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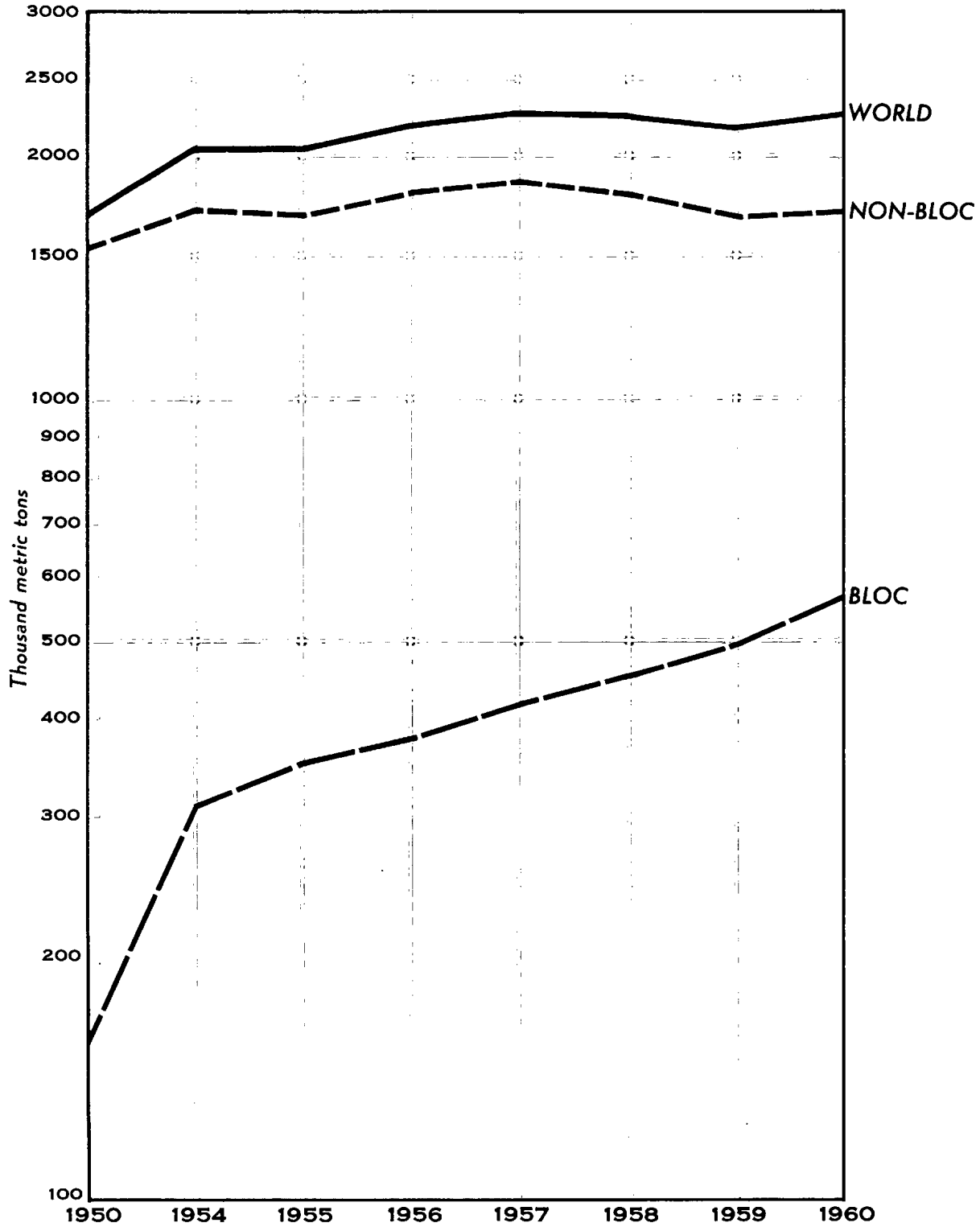
Figure 1

Sino-Soviet Bloc, Non-Bloc, and World, Production of Primary Lead, 1950, and 1954-60



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1. USSR

a. Mining

The bulk of the lead ore produced in the USSR (estimated to have ranged between 7 million and 12 million tons in 1959, with about 231,000 tons of refined metal content*) is mined in Kazakh SSR, the Central Asian republics, and East Siberia. 32/ About 60 percent of the total Soviet output is mined in Kazakh SSR alone. 33/ The single most important mining district in the USSR is the Rudnyy Altay area of Vostochno-Kazakhstanskaya Oblast in Kazakh SSR. This area, which includes the Irtysh, Leninogorsk, and Zyryanovsk ore fields, accounted for more than 40 percent of the total output of lead ore in the USSR in 1956. 34/

As the known deposits of high-quality ore have been exploited, the USSR has extended mining operations to include ore with a lower content of lead. 35/ In 1956 the quantity of lead recovered per ton of ore had diminished to 28 percent of the quantity per ton recovered in 1932. 36/ By 1960 the lead content of the ore processed is believed to have diminished even further and is stated to have ranged between 1 and 3 percent of the volume of ore. 37/

Although low-grade lead ore is costly to transport, about half of the ore and concentrate processed by Soviet lead plants during the Fifth Five Year Plan (1951-55) was shipped from great distances. 38/ As a matter of policy, Soviet lead plants have been located near lead deposits, but output since World War II from several of the mining areas has not been sufficient to supply the associated processing plants adequately. In Kazakh SSR, the principal lead mining region of the USSR, lead plants have been unable to operate steadily or to meet planned assignments, because of an inadequate local supply of ores and concentrates. 39/ For example, the Chimkent Lead Plant in Yuzhno-Kazakhstanskaya Oblast was built to process nearby reserves that had been overestimated. 40/ As a result, additional ore must be obtained from neighboring oblasts and from the Central Asian republics. 41/

During the Seven Year Plan a sizable increase in output of lead ore is planned for the USSR as a whole. Kazakh SSR and the Central Asian republics are planned to remain the largest producers of lead ore. Only 17 percent of the planned increase in mining capacity for lead and zinc ore** is to come from the construction of

* See Table 2, p. 10, above.

** Inasmuch as lead commonly occurs in association with zinc, official Soviet data often are in terms of "lead-zinc" ore.

new capacity. 42/ Preference in the construction of new capacity will be given to large enterprises such as the open-pit projects in Karagandinskaya Oblast in Kazakh SSR.* 43/

The most important development in the USSR in the mining of lead and zinc ore is the growing emphasis on the open-pit method, which is mechanized and more economical and labor-productive than the traditional and more expensive underground method.** In 1950 the open-pit method accounted for only 1.8 percent of the total amount of lead and zinc ore mined, but by 1957 the percentage had risen to 19.3 percent and by the end of the Seven Year Plan is to amount to 37 percent of the total. 44/

The underground mining of lead and zinc ore, however, will remain the predominant method of mining used throughout the Seven Year Plan. A considerable proportion of the Soviet reserves of lead and zinc ore, particularly those of better quality, occurs in conditions unfavorable for open-pit mining. 45/ To minimize costs, the USSR, especially since 1950, has been introducing such techniques as block caving, open stoping, shrinkage, and sublevel drifting, which are claimed to be more productive. 46/ The following tabulation shows the changes in the proportion of the total Soviet underground output of lead and zinc ore accounted for by the various underground mining methods in 1950 and 1957 47/:

	Percent of Total	
Method of Mining	1950	1957
Block caving	12.0	41.4
Open stoping	16.0	12.8
Shrinkage	11.0	11.5
Sublevel drifting	0	6.8
Top slicing (cover caving)	32.0	10.9
Cut and fill (horizontal slicing)	15.0	6.2
Other	14.0	10.4
Total	100.0	100.0

* For data on some individual mines presently in operation in the USSR, see Appendix A.

** See VI, A, 2, p. 40, below.

b. Concentrating

In the USSR, lead ore is concentrated primarily by flotation. Increasingly complicated concentrating techniques, including heavy media separation, have been introduced in recent years to process the lower grades of ore being mined and to decrease costs. Some concentrating plants are capable of processing ore having a lead content of as little as 0.5 percent. 48/ Furthermore, polymetallic ore now is being concentrated experimentally into collective concentrates that may then be processed further for several metals more or less simultaneously. In addition to being handicapped by the low metal content of the ore to be processed, however, concentrating plants in the USSR as a rule are rather inefficient because of general operating deficiencies, ineffective reagents, and the simple techniques that are still widely used.

Production of concentrates in the USSR is characterized by a low rate of recovery of metal from ore and a low metal content of the finished concentrate. During 1955-57, as much as 30 percent of the metal content of ore was lost, 49/ but by 1959 the rate of recovery had risen to between 80 and 90 percent, 50/ and measures are to be taken to increase the rate of recovery to between 90 and 95 percent during the Seven Year Plan. 51/ The average lead concentrate produced in the USSR contains only 45 to 50 percent lead, 52/ whereas concentrating plants of the Free World regularly produce concentrates containing 68 to 70 percent lead. 53/ During the Seven Year Plan, efforts are to be made to raise the average lead content of concentrate by 6 to 7 percent, which will have the effect of adding, according to Soviet claims, 18 to 20 percent to the total capacity of refining plants without additional capital investment. 54/

The USSR has at least 28 lead concentrating plants in operation and about 12 under construction. Some of the more important plants under construction are at Alaygyr, Karagayly, and Nikolayevsk in Kazakh SSR; Shirlovaya Gora in Chitinskaya Oblast in East Siberia; and Primorskaya in Primorskiy Kray in the Far East.*

c. Smelting and Refining

In 1960 the USSR is estimated to have produced 314,000 tons of primary refined lead, a quantity 2.8 times that produced in 1950 and probably, as in 1959, about 63,000 tons more than domestic mine output.** Although refined production has increased at an annual

* For information on selected concentrating plants in the USSR, see Appendix A, and for their location, see the map, Figure 2, inside back cover.

** See Table 2, p. 10, above.

rate of about 4 percent from 1955 through 1960, such a rate of increase was not sufficient to fulfill the goal of the abandoned Sixth Five Year Plan of 367,000 tons in 1960, 55/ nor will it be sufficient to fulfill the goal of the Seven Year Plan of 404,000 tons in 1965. Nevertheless, production in 1960 was almost seven times that in 1945, the year of the lowest production since the mid-1930's.

About 75 percent of the Soviet output of primary refined lead is produced in two plants, at Chimkent and Ust'-Kamenogorsk,* both in Kazakh SSR, 57/ and the remainder is produced at the Elektrotsink Plant in Severo-Osetinskaya ASSR and at the Tetyukhe Plant in Primorskiy Kray in the Far East.** A rough breakdown of Soviet production of refined lead metal by plant in 1960 is as follows:

Plant and Location	Thousand Tons
Chimkent, Kazakh SSR	67
Ust'-Kamenogorsk, Kazakh SSR	169
Elektrotsink, RSFSR	23
Tetyukhe, RSFSR	55
Total	314

If the production goal of the Seven Year Plan is to be met, nearly 90,000 tons of producing capacity*** will have to be added to the present capacity of about 320,000 tons by 1965. Of this increase, about 50,000 tons will result from the construction of two lead plants, one at the Altyn-Topkan Lead-Zinc (Concentrating) Combine in Uzbek SSR 58/ and the other in Chitinskaya Oblast in East Siberia. 59/ In addition, 10,000 tons annually are to be recovered by slag fuming installations, 60/ and the remainder will result from the expansion of the capacities of existing plants, primarily in Kazakh SSR. 61/

* Since 1956 the Leninogorsk Lead Plant has sent its output of crude lead to the Ust'-Kamenogorsk plant for refining. 56/ As a result, the Leninogorsk plant has increased its capacity for production of crude lead, and the Ust'-Kamenogorsk plant, utilizing an advanced refining technology, now recovers valuable components formerly lost at Leninogorsk.

** For additional information on metal-producing plants in the USSR, see Appendix B, and for the location of these metal-producing plants, see the map, Figure 2, inside back cover.

*** Because of the absence of data, capacity and production are assumed to be synonymous.

In the USSR, production of lead metal is accomplished primarily in two major operations. Roasted and briquetted lead concentrate is first smelted in blast furnaces to produce a crude lead of 92 to 99 percent purity. 62/ The crude lead is then refined by the pyrometallurgical method. Typical Soviet practice in production of refined lead metal is shown in the chart, Figure 3.* 63/ The most recent GOST standard,** 3778-56, for refined lead metal is as follows 64/:

	Percent of Total	
Mark	Lead Content	Permissible Maximum of Admixtures***
S0	99.992	0.008
S1	99.985	0.015
S2	99.95	0.05
S3	99.9	0.1
S4	99.6	0.4

2. European Satellites

In 1960 the European Satellites are estimated to have produced 115,800 tons of primary refined lead metal, or about 20 percent of the total output of the Bloc. In the same year, however, as in 1959, mine output probably exceeded output of primary refined lead by more than 40,000 tons. In spite of increases in actual tonnages produced, the Satellite share of the total output of primary refined lead of the Bloc declined from about 29 percent in 1950 to about 20 percent in 1955. Since 1955, however, the proportion produced by the Satellites has ranged between 20 and 22 percent. By 1965, mainly because of the greatly increased output planned for Bulgaria, the European Satellites may produce 200,000 tons, about 24 percent of total production of the Bloc. Poland, historically and through 1959 the largest producer of lead metal in the Satellites, was overtaken by Bulgaria in 1960. By 1965, Bulgarian production of lead is to be almost double that of Poland and almost one-half of the total production in the European Satellites. The estimated production of primary

* Following p. 16.

** Gosudarstvennyy obshchesoyuznyy standart (State All-Union standard). GOST standards are official Soviet government specifications for controlling the quality of a particular product.

*** Admixtures may include magnesium, iron, copper, zinc, arsenic, silver, tin, antimony, bismuth, calcium, and sodium.

refined lead metal in the European Satellites for 1950, 1954-60, and 1965 is given in Table 3.* For comparison, the estimated mine output of lead for 1954-59 is given in Table 4.**

a. Bulgaria

Bulgaria, of all the Satellites, has shown the most striking development of its lead industry. In 1960, output of lead and zinc ore was 12 times that of 1950, or almost 3.1 million tons, 65/ about 90 percent of which was mined in the eastern Rhodope Mountains. 66/ Production of lead concentrate quadrupled, increasing from 29,000 tons in 1950 to about 120,000 tons in 1960. 67/ Seven concentrating plants, five of which are located in the Rhodope mining region, were in operation in early 1960, and two others were under construction. Because of a lack of refining capacity, Bulgaria in the past has shipped ore and concentrate to other Bloc countries for refining, but two new refineries with a combined annual capacity of 40,000 tons are now in operation, 68/ one in Kurdzhali and one in Kurilo. Both plants are being enlarged, and another lead and zinc smelter and refinery, under construction near Plovdiv, is scheduled for completion in 1961. 69/

b. Czechoslovakia

In Czechoslovakia, lead ore is mined, concentrated, and refined chiefly in the Pribram area of Bohemia and in the Banska Stiavnica area of Slovakia. 70/ Production of 15,000 tons of lead metal in 1960 was about double the quantity produced in 1950, but little additional increase is expected by 1965.

c. East Germany

The East German lead industry, which produces the modest amount of 10,000 tons of primary metal annually, appears to have little prospect for marked increase in output. The industry is concentrated largely in the vicinity of Freiberg, an area that has been mined intensively for hundreds of years. Approximately 255,000 tons of ore with a lead content of about 2 percent are mined each year by the VEB Bleierzgruben Albert Funk 71/ and are concentrated by flotation in the Beihilfe and Himmelsfahrt plants nearby. Concentrate is smelted and refined in the two plants of the VEB Freiberger Bleihuetten. In addition, a lead smelter and refinery at Hettstedt

* Table 3 follows on p. 17.
** Table 4 follows on p. 18. For information on the principal mines, concentrating plants, and smelters and refineries in the European Satellites, see Appendixes A and B, and for the location of all facilities but the mines, see the map, Figure 2, inside back cover.

Figure 3

USSR: Production of Primary Refined Lead

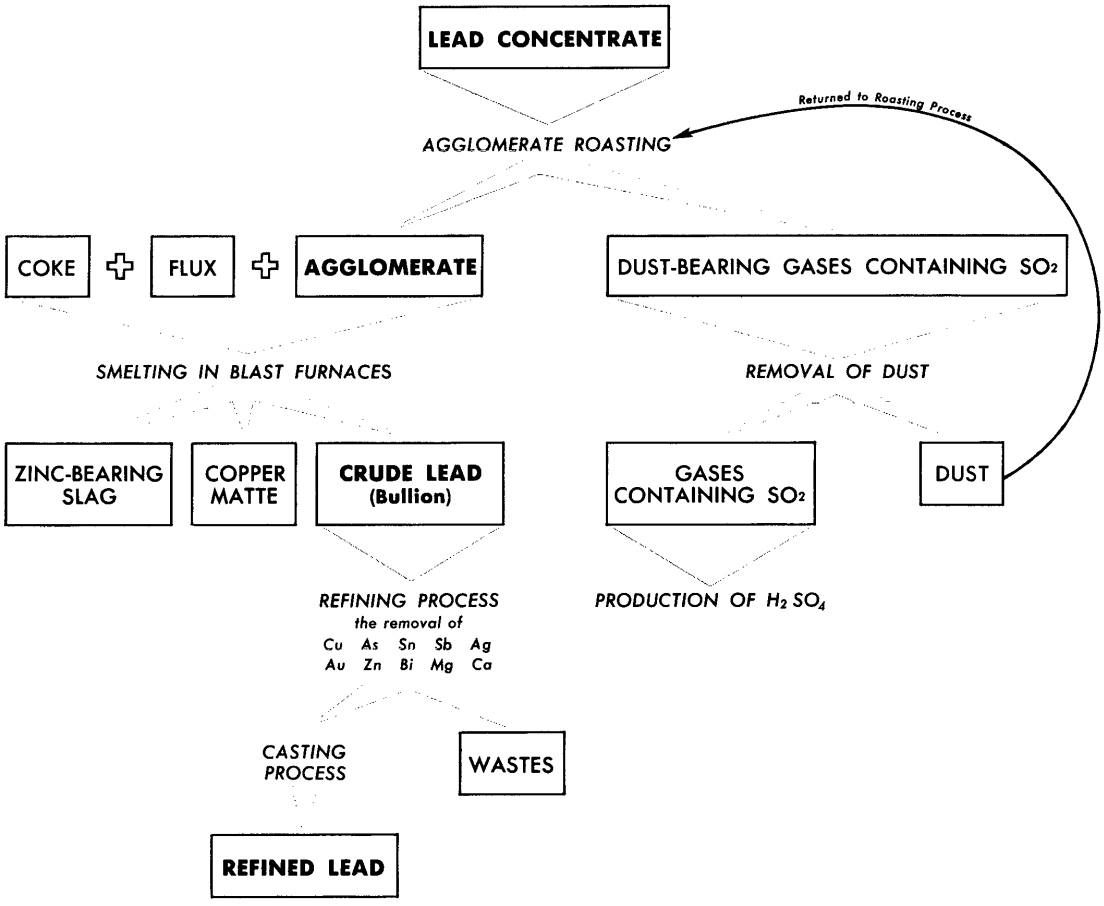

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Table 3

Estimated Production of Primary Refined Lead in the European Satellites
1950, 1954-60, and 1965

Thousand Metric Tons

Year	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Rumania	Total
1950	2.8	7.6	4.8	0	22.2	8.6	46.0
1954	4.6	10.0	9.1	0	31.9	10.6	66.2
1955	5.1	10.0	8.9	0	34.2	11.1	69.3
1956	6.0	11.0	10.7	0.5	34.2	13.3	75.7
1957	19.3	12.0	10.0	0.5	34.2	15.5	91.5
1958	26.1	13.0	9.5	0.5	34.2	15.5	98.8
1959	33.0	14.0	10.6 a/	0.5	34.2	15.5	107.8
1960	40.0	15.0 b/	10.6	0.5	34.2	15.5	115.8
1965	93.0 b/	17.5 b/	12.0	1.0	47.0	30.0	200.5

a. Including the lead content of ore imported from Algeria, estimated to be 180 metric tons.
b. Planned.

Table 4

Estimated Mine Output of Lead in the European Satellites a/
1954-59

Thousand Metric Tons

Year	Bulgaria b/	Czechoslovakia	East Germany	Hungary	Poland	Rumania	Total
1954	39.8	10.0	9.1	0	31.9	10.6	101.4
1955	45.0	10.0	8.9	0	34.2	11.1	109.2
1956	46.5	11.0	10.7	0.5	34.2	13.3	116.2
1957	64.8	12.0	10.0	0.5	34.2	15.5	137.0
1958	72.3	13.0	9.5	0.5	34.2	15.5	145.0
1959	75.7	14.0	10.4	0.5	34.2	15.5	150.3

a. In terms of the estimated refined metal content.
b. Data include estimated exports of lead in unrefined form and, therefore, will not agree with data in Table 3, p. 17, above.

produces about 3,000 tons of lead annually as a byproduct from copper ore. A new lead plant may be built during 1963-65, 72/ but, in view of past failures to construct such a plant, little increase in production can be expected by 1965.

d. Hungary

Since 1949, Hungary has been mining a small quantity of lead from deposits once abandoned as uneconomical in the Gyongyosoroszi mining district. A concentrating plant was built at this location in 1955. Domestic concentrate and some Bulgarian concentrate are refined in the Metallochemia plant at Nagyteteny to produce about 500 tons of primary metal annually. 73/ Production in 1965 may be as high as 1,000 tons.

e. Poland

At present, Poland is the second largest producer of lead in the European Satellites, and prospects are good for a considerable increase in output in the near future. In 1960, output of lead and zinc ore probably was about 2.4 million tons, nearly twice the 1.3 million tons produced in 1950, and output by 1965 is expected to increase further, to 3.6 million tons. 74/ Production of primary refined lead increased from 22,200 tons in 1950 to 34,200 tons in 1960, and about 47,000 tons are planned to be produced in 1965.

Two major developments are taking place in the Polish lead industry. Oxide ore, previously considered too difficult and costly to process, now is to be utilized. Large quantities of such ore containing only 0.58 percent to 0.75 percent lead have accumulated in dumps. 75/ After 1965 the tonnage of oxide ore concentrated probably will be as great as that of the more profitable sulfide ore. In addition, investments in the old mining area near Bytom are being curtailed, 76/ and new construction or expansion is being concentrated in the eastern region near Olkusz. The production from the Bytom area is expected to decline quickly from 80 to 60 percent of the total Polish output, 77/ and nearly all the increase in output planned by 1965 is to come from the Olkusz-Chrzanow area.

In spite of the importance of Poland as a producer of lead, little is known about the facilities now in operation. Four mines probably are located near Bytom and two near Olkusz. Two additional mines reportedly are going into operation near Olkusz, and development of a third is planned in 1961-65. 78/ Ore is concentrated by flotation in two plants near Bytom and one near Olkusz, and a large lead-zinc combine is planned to be constructed during 1961-65 to process oxide ore. 79/ Poland possesses possibly four plants that smelt or refine lead, and a new plant is planned to be operating in 1966. 80/

f. Rumania

Although lead is quantitatively the most important nonferrous metal produced in Rumania and although the country is the third largest producer of lead in the European Satellites, output is small -- less than 3 percent of the Bloc's output in 1960. By 1965, when production is to be nearly doubled, the Rumanian share of the Bloc's output will not have increased appreciably. Lead ore is mined in the regions of Baia-Mare, Hunedoara, Timisoara, and Oradea and is concentrated by flotation in plants near the mines. 81/ Although some concentrate is smelted at the Gheorghe Doja plant in Zlatna, most of it is smelted and refined in the Gheorghiu Dej Metallurgical and Chemical Plant in Baia-Mare and in the 1 Mai plant in Firiza. 82/ Production rose from about 11,100 tons in 1955 to about 15,500 tons in 1960 and is planned to increase to 30,000 tons by 1965.

3. Asian Bloc

Production of lead increased very rapidly in the Asian Bloc during 1950-60, and in 1960, for the first time, the combined output of these countries exceeded that of the European Satellites. As a result of the destruction and dismantling of facilities during and immediately after World War II, these two countries produced only 2,800 tons of primary refined lead, or less than 2 percent of the total output of the Bloc, in 1950. Since that time, however, a vigorous program of reconstruction and development has taken place, so that by 1960 production had jumped to 137,000 tons, or about 24 percent of the Bloc total. By 1965 the projected production of 215,000 tons should constitute about 26 percent of the estimated output of the Bloc. The estimated production of primary refined lead metal in Communist China and North Korea for 1950, 1954-60, and 1965 is given in Table 5.* For comparison, the estimated mine output of lead for 1954-59 is given in Table 6.**

a. Communist China

Most of the facilities now being used by the lead industry in Communist China have been developed since the advent of the Communist regime. Although much of the ore mined recently has been obtained from a host of small, primitive, "native" operations, 83/ an increasing output is being achieved from a number of new, modern, and relatively large mines. The mines developed by the Japanese and those developed or modernized with Soviet aid presumably are at least partly mechanized, but primitive hand-labor methods continue to be

* Table 5 follows on p. 21.
** Table 6 follows on p. 21.

Table 5

Estimated Production of Primary Refined Lead
in the Asian Bloc
1950, 1954-60, and 1965

Thousand Metric Tons

Year	Communist China	North Korea	Total
1950	2.8	Negl.	2.8
1954	15.0	3.3	18.3
1955	16.0	9.4	25.4
1956	17.0	15.0	32.0
1957	31.0	17.0	48.0
1958	45.0	19.0	64.0
1959	70.0	23.0	93.0
1960	110.0	27.0	137.0
1965	170.0	45.0	215.0

Table 6

Estimated Mine Output of Lead
in the Asian Bloc a/
1954-59

Thousand Metric Tons

Year	Communist China	North Korea	Total
1954	19.5	22.1	41.6
1955	21.2	30.8	52.0
1956	26.4	26.0	52.4
1957	39.9	26.9	66.8
1958	54.5	27.6	82.1
1959	76.0	31.3	107.3

a. In terms of the estimated refined metal content.

used for many operations. Concentrating plants near the major mines process ore primarily by flotation, but at the "native" mines hand sorting and simple hand-operated gravity and flotation methods are used. Between 1950 and 1953 the Chinese Communists, with Soviet aid, rehabilitated the pre-Communist smelting and refining plants, which had been nearly inoperative. By 1957 the capacity of these plants was increased to about 20,000 tons, additional new refining capacity was installed in Yunnan Province, 84/ and construction was begun on a plant in Hunan Province. 85/ A copper, lead, and zinc plant with a designed capacity of 60,000 tons of refined lead annually reportedly was under construction at Shao-kuan in Kwangtung Province in 1958. 86/ Furthermore, as a result of the development of deposits of the Tsaidam Basin in Tsinghai Province, a new refining facility of the size of the Shao-kuan plant presumably will have to be constructed and will be in operation there by 1965.

Production of primary refined lead is rising sharply: it increased from 2,800 tons in 1950 to about 110,000 tons in 1960 and may be as high as 170,000 tons by 1965. The present level of output greatly exceeds the peak output of about 12,000 tons in the pre-Communist era, 87/ and China now is the second largest producer of lead in the Bloc. Moreover, the projected output of about 170,000 tons in 1965 would rank Communist China fourth or fifth among the principal producers of lead of the world.*

Although the quality of production from small "leap forward" types of installations is in general quite poor, the larger modern facilities have attained increasingly higher standards. In four concentrating facilities during 1957-58 the rate of recovery of metal from ores, although below the standards of the Free World, ranged from 80 to 90 percent, and during the same period the metal content of concentrates produced at five major plants was within a satisfactory range of 57 to 67 percent. 89/ Both the crude (bullion) and the refined lead produced in the major smelting and refining plants are comparable in quality with those produced in the rest of the world. Eighty-eight percent of the metal refined during 1958-59 was of grade S0 (99.992 percent), which is the Soviet standard for first-grade metal.** 90/

* For example, in 1958 the world's leading producers of lead -- the US, the USSR, Australia, Mexico, and West Germany -- produced about 425,000, 290,000, 255,000, 200,000, and 135,000 tons, respectively. 88/

** See the tabulation on p. 15, above. For additional information on mines, concentrating plants, and smelters and refineries in Communist China, see Appendixes A and B, and for the location of all facilities but the mines, see the map, Figure 2, inside back cover.

b. North Korea

North Korea mines both sulfide and oxide ores, but through 1960 sulfide ore was the principal raw material utilized. During 1955-59 an average of about 29,000 tons of lead in ore was mined annually.* Until recently, all of the oxide ore, which is difficult to process, and much of the sulfide ore and concentrate have been exported. 91/

During 1955-60 an increasingly greater proportion of the ore and concentrate produced was smelted and refined in North Korea. Production of refined lead nearly tripled, to about 27,000 tons, in 1960. Insofar as is known, however, the plant at Munp'yong is the only lead smelting and refining facility in North Korea.**

B. Secondary

Production of secondary lead metal is as yet much less important in the Bloc than in the highly industrialized countries of the Free World. In 1960, at least 75,000 tons of secondary lead were produced in the Bloc, whereas in 1959 about 950,000 tons were produced in the Free World. 92/ Furthermore, in 1960 the estimated output of secondary metal in the Bloc constituted about 12 percent of the total production of lead of that area, whereas in the US in 1959 more than one-half of the total production was in the form of secondary metal. 93/ Nearly three-fourths of the secondary lead output of the Bloc is produced by the USSR, and, of the remaining countries, only East Germany and Poland are known to produce appreciable quantities at present.

1. USSR

As a result of the growth in production and consumption of primary lead metal since 1950, the USSR has been able to increase production of secondary metal also. Output rose from about 32,000 tons in 1953 to 55,000 tons in 1960 and now makes up about 15 percent of the total production of lead. Estimated production of secondary metal in selected years and the planned goal for 1965 are as follows:

Year	Thousand Tons
1953	32
1955	36 to 38
1956	41 to 44
1957	46 to 47
1958	49
1959	52
1960	55
1965 (Plan)	72

* In terms of refined metal content (see Table 6, p. 21, above).
** For additional information on mines, concentrating plants, and smelters and refineries in North Korea, see Appendixes A and B, and for the location of all facilities but the mines, see the map, Figure 2, inside back cover.

The plants that produce secondary lead are located in the heavily industrialized areas of the USSR where most of the old lead scrap accumulates. 94/ The major producer probably is the Ukrtsink Plant in the Ukrainian SSR, which is estimated to produce about 30,000 tons of secondary lead annually. 95/ Secondary lead also is known to be recovered at the Moscow Copper Smelting and Electrolytic Plant, 96/ at the Podol'sk Secondary Nonferrous Metals Plant south of Moscow, 97/ at the Verkhneyvinsk Secondary Nonferrous Metals Plant (location not established), 98/ and at two unidentified plants in the Urals. 99/

Secondary lead is recovered from scrap primarily by the pyrometallurgical method in blast furnaces, and, depending on the purity desired, it may then be refined electrolytically. 100/ Soviet technology used in production of secondary lead is not so advanced as that employed in production of secondary aluminum, brass, and bronze, 101/ but electrothermic smelting, a more efficient technique, may replace blast smelting at the Podol'sk and Ukrtsink plants. 102/

2. European Satellites

East Germany, Poland, and Hungary produce most of the relatively minor output of secondary lead in the European Satellites. In East Germany, about 13,000 tons are produced annually. This quantity, which makes up more than half of the total annual production of lead in the Satellites, is produced in the smelting and refining facilities of the VEB Freiberger Bleihuetten near Freiberg and in the VEB Berliner Metallhuetten- und Halbzeugwerke Berlin (VEB BMHB) in Berlin-Schoeneweide. The VEB BMHB plant produces several thousand tons of electrolytic lead each year. 103/ In Poland, output of secondary lead, recovered largely from battery scrap, reportedly accounted for the increase in the total production of lead during the recently completed Five Year Plan (1956-60). 104/ Secondary production, therefore, probably was about 5,500 tons in 1960. Hungary refines about 1,000 tons of secondary lead annually from remelted scrap at the Metallochemia plant in Nagyteteny, 105/ an output which is double that of the country's output of primary lead.

IV. Trade*

Trade in lead in the Bloc consists for the most part of intra-Bloc trade rather than trade with countries of the Free World. In 1959, intra-Bloc trade amounted to about three-fourths of the approximately

* All trade is presumed to be in primary raw materials and metal. Unless otherwise indicated, throughout this section, trade in lead includes trade in ore and concentrate in terms of their estimated metal content as well as trade in primary refined lead metal.

183,000 tons of total trade in lead and consisted mainly of the following three major movements: (1) countries with insufficient smelting and refining capacity exported ore and concentrate, (2) countries with excess refining capacity imported ore and concentrate, and (3) countries with requirements in excess of domestic supply imported lead metal. The remaining one-fourth of the total consisted of trade with the Free World. During 1955-59, imports of lead by the Bloc from the Free World exceeded exports. By 1959, however, the difference between imports and exports had decreased to about 3,300 tons, and in 1960, according to preliminary data, exports by the Bloc exceeded imports by about 11,000 tons.

A. Intra-Bloc

Intra-Bloc trade is the most important aspect of Bloc trade in lead. The quantity of such trade, including the refined metal content of ore and concentrate, grew from 92,000 tons in 1955 to 140,000 tons in 1959. Considerable cooperation appears to have been developed in the utilization of facilities and in the distribution of the refined metal. Bulgaria, North Korea, and Communist China export ore and concentrate for the most part because they lack sufficient smelting and refining capacity. Poland imports some ore and concentrate to make use of an excess of smelting and refining capacity and also imports metal, partly for reexport. East Germany, Czechoslovakia, Hungary, and Rumania import refined metal to meet domestic requirements. Known intra-Bloc trade in lead for 1959 is given in Table 7.*

The USSR is the dominating figure in the picture of intra-Bloc trade in lead. Since World War II it has imported large quantities of ore and concentrate from Bulgaria, North Korea, and Communist China for smelting and refining. That part of the refined metal not used in the USSR has in turn been exported mainly to Czechoslovakia, East Germany, and Hungary and to a lesser degree to Poland, Albania, and North Vietnam. In 1955 the lead content of ore and concentrate imported from all other countries was about double the quantity of refined lead exported. By 1959, however, the quantity of refined lead exported was almost equal to the lead imported in unrefined form. The Soviet role as processor of raw materials for other countries of the Bloc probably will diminish as Bulgaria, North Korea, and Communist China develop new smelting and refining capacity. These three countries not only plan to consume greater quantities of lead but also may provide a greater share of the metal required by those Satellites that are not self-sufficient in lead.

* Table 7 follows on p. 26.

Table 7

Trade in Lead Between Countries of the Sino-Soviet Bloc a/
1959

Metric Tons

Importing Country	Exporting Country: USSR	Bulgaria	Hungary	Poland	Communist China	North Korea	Total Imports
USSR		45,873 b/ c/ d/			6,000 b/ e/	16,800 b/ f/	68,673
Albania	87 b/ g/						87
Czechoslovakia	11,000 b/	6,086 d/					17,086
East Germany	30,000 b/	1,449 d/		1,760 h/	162 i/		33,371
Hungary	5,700 b/	790 d/					6,490
Poland	3,789 h/	4,093 d/	254 h/		2,957 h/	302 h/	11,395
Rumania		1,002 d/					1,002
Communist China						2,000 j/	2,000
North Vietnam	9 b/ k/						9
Total exports	50,585	59,293	254	1,760	9,119	19,102	140,113

a. All figures are in refined metal unless otherwise indicated.
b. 106/
c. Including 42,700 metric tons of refined lead content of concentrates (estimated) and 3,173 metric tons of primary refined metal.
d. 107/
e. Refined lead content of ore (estimated).
f. Including 8,500 metric tons of primary refined lead, 7,000 metric tons (estimated) refined content of crude lead, and 1,300 metric tons (estimated) refined lead content of ore.
g. Including primary refined lead and rolled lead.
h. 108/
i. 109/
j. 110/
k. Rolled lead.

B. Bloc - Free World

The quantity of lead traded between the Bloc and the Free World has always been relatively small. For example, only about 43,000 tons of lead were involved in this trade in 1959, and this amount probably was the largest quantity traded in any single year since the formation of the Bloc. During 1955-59, approximately two-thirds of the imports by the Bloc were metal and the remainder ore, but all exports were in the form of metal. Most of the imported metal came from Yugoslavia and most of the imported ore from Iran. Exports by the Bloc to the Free World went primarily to industrialized countries of Western Europe and to certain underdeveloped countries. The principal countries of the Bloc that imported lead from the Free World were the USSR, Czechoslovakia, Poland, and (in 1958) Communist China, whereas the only countries known to have made significant exports to the Free World were the USSR, Bulgaria, Poland, and (in 1959) Czechoslovakia. Known trade in lead between the Bloc and the Free World is as follows:

	Thousand Tons					
	1955	1956	1957	1958	1959	1960*
Bloc imports	14.8	26.9	21.7	21.3	23.3	13.8
Bloc exports	0.7	Negl.	5.9	11.3	19.9	24.9
Net imports	14.1	26.9	15.8	9.9**	3.3**	
Net exports						11.1

In spite of the fragmentary nature of the data, several main trends in the trade in lead between the Bloc and the Free World can be discerned. Yugoslavia, having increased exports to the Bloc from 10,500 tons in 1956 to 15,500 tons in 1959, has become the chief supplier of lead in the Free World. In terms of lead content, imports reached their peak in 1956. Since then, at least until 1960, they have settled at a fairly constant level. Meanwhile, exports have increased, so that by 1959 the margin of imports over exports had decreased to about 3,300 tons. Preliminary data indicate that the Bloc became a net exporter of lead in 1960 for the first time. Although more than half of the trade has been conducted by the USSR, that country remains a net importer. Bulgaria in 1958 and both Bulgaria and Poland in 1959 achieved sizable net exports of lead and may, in fact, have taken over from the USSR some of the exportation of lead metal to Western European

* Preliminary estimate.

** Because of rounding, components do not add to the totals shown.

countries. Details of the Bloc's trade in lead with countries of the Free World in 1959 are given in Table 8.*

V. Supply and Consumption

In recent years the Sino-Soviet Bloc has been approaching self-sufficiency in lead, and this goal apparently was achieved in 1960. From 1955 to 1959, the quantity of new supply from domestic resources increased steadily at an average annual rate of about 9 percent, or from about 398,000 tons to about 559,000 tons. During the same period, consumption increased at a slightly lower rate. As a result, although the Bloc was still a net importer of lead from the Free World in 1959, these imports amounted to slightly more than 3,000 tons in comparison with more than 14,000 tons in 1955 and nearly 27,000 tons in 1956. Preliminary data indicate that in 1960 the Bloc for the first time became a net exporter of lead. Relevant data on supply and distribution of lead in the Bloc during 1955-59 are given in Table 9.**

The USSR, which dominates supply and consumption of lead within the Bloc, is deficient in lead; the European Satellites are essentially self-sufficient; and Communist China and North Korea produce more lead than they consume. In 1959 the USSR accounted for about 55 percent of the total consumption of the Bloc while contributing only about one-half of the total domestic supply available in that area. Consequently, Soviet imports exceeded exports by almost 27,000 tons. In the same year the European Satellites accounted for slightly less than 31 percent of the Bloc's consumption while contributing slightly less than that percentage of the Bloc's total domestic supply. Also in 1959, Communist China and North Korea accounted for slightly more than 14 percent of the Bloc's total consumption while contributing slightly more than 19 percent of the Bloc's domestic supply. As a result, these countries exported slightly more than 26,000 tons and apparently received no significant imports. Details on the intra-Bloc supply and distribution of lead in 1959 are given in Table 10.***

A. USSR

For a number of years the USSR has experienced a shortage of lead. 111/ Although domestic production increased from about 224,000 tons in 1955 to 283,000 tons in 1959, at an average annual rate of increase of about 6 percent, the gap between domestic production and consumption persisted. The USSR is attempting to solve its supply problem

* Table 8 follows on p. 29.
** Table 9 follows on p. 30.
*** Table 10 follows on p. 32.

Table 8

Trade in Lead Between the Sino-Soviet Bloc and the Free World a/
1959

Metric Tons

Free World Country	Bloc Country						
	USSR b/	Bulgaria	Czechoslovakia	East Germany	Poland c/	Communist China	Total
Algeria				180 d/ e/			180
Austria		1,191 f/	30 g/		71		1,292
Denmark		144 f/					144
Finland	6,100						6,100
Greece		20 h/					20
India	500						500
Iran	6,390 e/						6,390
Netherlands		2,909 f/			4,076		6,985
Spain			1,200 g/				1,200
Sweden					15		15
UK					1,523		1,523
Uruguay		300 i/					300
West Germany		1,848 f/	1,070 g/		132	10 g/	3,060
Yugoslavia	9,000		3,500 j/		3,000		15,500
Total exports	6,600	6,412	1,100		5,817	10	19,939
Total imports	15,390		4,700	180	3,000		23,270
Net	8,790	6,412	3,600	180	2,817	10	3,331

a. Figures for imports are in black, and figures for exports are in red. All figures are in refined lead except those for Algeria and Iran, which are in terms of the estimated refined metal content.
b. 112/
c. 113/
d. 114/
e. Estimated.
f. 115/
g. 116/
h. 117/
i. 118/
j. 119/

Table 9

Estimated Supply and Distribution of Lead in the Sino-Soviet Bloc a/
1955-59

Thousand Metric Tons

	1955	1956	1957	1958	1959
Supply					
Mine output b/	347.8	370.8	408.4	443.2	488.2
Secondary output b/	50.5	57.3	62.0	64.6	71.0
Total domestic supply	398.3	428.1	470.4	507.8	559.2
Known imports from the Free World c/	14.8	26.9	21.7	21.3	23.3
Total new refined supply	413.1	455.0	492.1	529.1	582.5
Distribution					
Known exports to the Free World c/	0.7	Negl.	5.9	11.3	19.9
Estimated consumption d/	412.4	455.0	486.2	517.8	563.3
Total distribution	413.1	455.0	492.1	529.1	583.2
Estimated change in stocks	Negl.	Negl.	Negl.	Negl.	-0.7 e/

a. In terms of the estimated refined metal content.
b. See III, p. 9, above.
c. See IV, p. 24, above.
d. Mine and secondary output plus imports minus exports, except for 1959, which is shown in Table 10, p. 32, below.
e. See Table 12, p. 35, below, for available data on minor stock changes in the European Satellites.

by accelerating geological prospecting, 120/ by adopting more efficient processes, 121/ and by increasing the recovery of secondary lead from scrap, all of which measures should result in increases in domestic production. The USSR also is importing lead in several forms and is substituting other metals and plastics wherever possible. 122/

Through the Seven Year Plan, lead probably will continue to be in short supply. The production goal for lead is lower in terms of percentage increase than that of any other major nonferrous metal, with the possible exception of tin. The relatively modest increase planned is partly due to the growing substitution for lead of cheaper materials, primarily aluminum* and plastics but also steel, nickel, and other metals. 123/ As a result of planned substitutions, nearly 215,000 tons of lead are expected to be saved annually, thereby reportedly making unnecessary the construction of smelting and refining facilities with that capacity. 124/

The uses of lead in the USSR are similar to those in the US. The proportion of the total supply of lead that is consumed in production of batteries, cable covering, and solder, for example, is at least 52 percent in the USSR compared with 46 percent in the US. 125/ The consumption requirements for lead in the USSR in recent years, by major categories, are given in Table 11.**

B. European Satellites

Most of the European Satellites use more lead than they produce, import to augment supply, and maintain very small stocks. Consumption, therefore, is believed to be approximately equivalent to total new supply for most of the Satellite countries. Bulgaria is a marked exception, however, for in 1959, out of a production of 33,000 tons of refined lead, less than one-third (9,900 tons) was consumed 126/ and the remainder was exported. Moreover, 43,000 tons of lead in the form of concentrate were shipped to the USSR. By 1965, when the domestic production of refined lead in Bulgaria is planned to be 93,000 tons, consumption is scheduled to be only 53,800 tons. 127/ Most of the excess supply at that time presumably will be exported, with metal exports perhaps completely replacing exports of concentrate.***

* This situation is in contrast with that in the Free World, where costs of production and selling prices of lead are much lower than those of aluminum (see VI, p. 37, below). Nevertheless, the Free World also is substituting aluminum for lead, primarily in cable coverings, mainly because of its weight advantage per unit of volume but also because of the superior strength demonstrated in its resistance to creep, vibration, and fatigue.

** Table 11 follows on p. 34.

*** Text continued on p. 34.

Table 10

Estimated Supply and Distribution of Lead in the Sino-Soviet Bloc, by Area a/*
1959

Thousand Metric Tons

	USSR	European Satellites	Asian Bloc	Total
Supply				
Mine output b/	230.6	150.3	107.3	488.2
Secondary output b/	52.0	19.0	Negl.	71.0
Total domestic supply	282.6	169.3	107.3	559.2
Unrefined imports c/				
From Bloc countries	57.0	0	0	
From the Free World	6.4	0.2	0	6.6
Unrefined exports c/				
To Bloc countries	0	42.7	14.3	
Total domestic refined supply	346.0	126.8	93.0	565.8
Refined imports c/				
From Bloc countries	11.7	54.0	0	
From the Free World	9.0	7.7	Negl.	16.7
Total new refined supply	366.7	188.5	93.0	582.5 d/

* Footnotes for Table 10 follow on p. 33.

Table 10

Estimated Supply and Distribution of Lead in the Sino-Soviet Bloc, by Area a/
1959
(Continued)

Thousand Metric Tons

	USSR	European Satellites	Asian Bloc	Total
Distribution				
Refined exports c/				
To Bloc countries	50.6	3.2	11.9	
To the Free World	6.6	13.3	Negl.	19.9
Estimated consumption e/	309.5	172.7	81.1	563.3
Total distribution	366.7	189.2	93.0	583.2 d/
Estimated change in stocks	Negl.	-0.7	Negl.	-0.7

a. In terms of the estimated refined metal content.
b. See III, p. 9, above.
c. See IV, p. 24, above.
d. To avoid double counting of trade among Bloc countries, the total shown is the sum of the numbers in the vertical column only.
e. Mine and secondary output plus imports minus exports adjusted by small changes in stocks in the European Satellites (see Table 12, p. 35, below).

East Germany, the largest consumer of lead among the Satellites, has maintained small stocks of 4,000 to 8,000 tons since 1955 and thus was able to consume more than 58,000 tons of lead in 1959 in spite of a new supply of slightly less than that amount. The estimated supply and distribution of lead for the European Satellites in 1959 are given in Table 12.*

Table 11

Estimated Consumption Requirements for Lead in the USSR
1959

Commodity	Percent of Total	Thousand Metric Tons
Batteries	28 to 33 a/ b/	87 to 102
Cable covering	12 to 16 a/	37 to 50
Solder	12 to 15 a/	37 to 46
Machine construction alloys (bearing, typographic, and the like)	12 to 15 b/	37 to 46
Other	36 to 21	112 to 65
Total	100	310 c/

a. 128/
b. 129/
c. See Table 10, p. 32, above. Because of rounding, components may not add to the total shown.

In the European Satellites the pattern of lead consumption probably is similar to that in the USSR. Data on major categories of consumption requirements are available, however, only for Bulgaria. In 1959 and 1960, Bulgaria planned to distribute lead for consumption as follows 130/:

Commodity	Percent of Total	
	1959	1960
Batteries	22.8	25.8
Cables	22.2	26.0
Lead articles	9.0	8.6
Enamel	5.5	5.6
Minium (red oxide)	12.5	18.0
Other	28.0	16.0
Total	100.0	100.0

* Table 12 follows on p. 35.

Table 12

Estimated Supply and Distribution of Lead in the European Satellites a/*
1959

Thousand Metric Tons

	Albania	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Rumania	Total
Supply								
Mine output b/	0	75.7	14.0	10.4	0.5	34.2	15.5	150.3
Secondary output b/	0	Negl.	Negl.	13.5	1.0	4.5	Negl.	19.0
Total domestic supply	0	75.7	14.0	23.9	1.5	38.7	15.5	169.3
Unrefined imports c/								
From the Free World	0	0	0	0.2	0	0	0	0.2
Unrefined exports c/								
To Bloc countries	0	42.7	0	0	0	0	0	42.7
Total domestic refined supply	0	33.0	14.0	24.1	1.5	38.7	15.5	126.8
Refined imports c/								
From the European Satellites	0	0	6.1	3.2	0.8	4.3	1.0	
From the USSR and the Asian Bloc	0.1	0	11.0	30.2	5.7	7.0	Negl.	54.0
From the Free World	0	Negl.	4.7	Negl.	Negl.	3.0	Negl.	7.7
Total new refined supply	0.1	33.0	35.8	57.5	8.0	53.0	16.5	188.5 a/

* Footnotes for Table 12 follow on p. 36.

Table 12

Estimated Supply and Distribution of Lead in the European Satellites a/
1959
(Continued)

Thousand Metric Tons

	Albania	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Rumania	Total
Distribution								
Refined exports c/								
To the European Satellites	0	13.4	Negl.	0	0.2	1.8	Negl.	
To the USSR and the Asian Bloc	0	3.2	Negl.	0	0	0	Negl.	3.2
To the Free World	0	6.4	1.1	Negl.	Negl.	5.8	Negl.	13.3
Estimated consumption	0.1 e/	9.9 f/	34.7 e/	58.3	7.8 e/	45.4 e/	16.5 e/	172.7
Total distribution	0.1	32.9	35.8	58.3	8.0	53.0	16.5	189.2 d/
Estimated change in stocks	Negl.	+0.1	Negl.	-0.8	Negl.	Negl.	Negl.	-0.7

a. In terms of the estimated refined metal content.
b. See III, p. 9, above.
c. See IV, p. 24, above.
d. To avoid double counting of trade among the European Satellites, the total shown is the sum of the numbers in the vertical column only.
e. Mine and secondary output plus imports minus exports.
f. Planned.

By 1965, Bulgaria plans to allocate more than 62 percent of its lead to batteries and cables compared with 45 percent in 1959 and almost 52 percent in 1960. 131/

C. Asian Bloc

In the Asian Bloc the annual production of lead is more than adequate to meet requirements. Although no specific data are available, most of the lead consumed is believed to be used in the manufacture of batteries, cables, alloys, and pigments. Communist China consumes a quantity of metal about equal to that refined domestically, but North Korea consumed only slightly more than half of the 23,000 tons that it produced in 1959. No national stockpiles are known to be maintained in either of these countries. The estimated supply and distribution of lead in Communist China and North Korea in 1959 are given in Table 13.*

VI. Investment, Cost, and Price

Little information is available on the economic aspects of the lead industries of any of the countries in the Sino-Soviet Bloc. Some data on investment, cost, and price in the lead industries of the USSR and East Germany have been obtained, but no similar data are available for the other countries of the Bloc.

A. USSR

1. Capital Investment

Capital investment in the Soviet lead industry during the Seven Year Plan is scheduled to be increased by 15 percent above the level of the preceding 7 years, 1952-58, 132/ and, it is estimated, will amount to 1.5 billion rubles,** or about 2.7 percent of the total investment of 55 billion rubles allocated to nonferrous metallurgy as a whole. 133/ The 15-percent increase in capital investment is planned to result in an increase of about 40 percent in production of lead during the same period. 134/ Thus each 1 percent of increase in investment reportedly is to result in a 2.6-percent increase in production of lead. 135/

During the Seven Year Plan the efficiency of capital investment in the lead industry is to be improved in several ways.***

* Table 13 follows on p. 38.

** Ruble values in this report are given in old (pre-1961) rubles and may be converted to US dollars at a rate of exchange of 4 rubles to US $1. This rate does not necessarily reflect the value of the ruble in terms of dollars.

*** Text continued on p. 40.

Table 13

Estimated Supply and Distribution of Lead in the Asian Bloc a/*
1959

Thousand Metric Tons

	Communist China	North Korea	Total
Supply			
Mine output b/	76.0	31.3	107.3
Secondary output b/	Negl.	Negl.	Negl.
Total domestic supply	76.0	31.3	107.3
Unrefined exports c/			
To Bloc countries	6.0	8.3	14.3
Total domestic refined supply	70.0	23.0	93.0
Refined imports c/			
From the Asian Bloc	2.0	0	
From the USSR and the European Satellites	Negl.	0	Negl.
From the Free World	Negl.	0	Negl.
Total new refined supply	72.0	23.0	93.0 d/

* Footnotes for Table 13 follow on p. 39.

Table 13

Estimated Supply and Distribution of Lead in the Asian Bloc a/
1959
(Continued)

Thousand Metric Tons

	Communist China	North Korea	Total
Distribution			
Refined exports c/			
To the Asian Bloc	0	2.0	
To the USSR and the European Satellites	3.1	8.8	11.9
To the Free World	Negl.	0	Negl.
Estimated consumption e/	68.9	12.2	81.1
Total distribution	72.0	23.0	93.0 d/
Estimated change in stocks	Negl.	Negl.	Negl.

a. In terms of the estimated refined metal content.
b. See III, p. 9, above.
c. See IV, p. 24, above.
d. To avoid double counting of trade between Communist China and North Korea, the total shown is the sum of the numbers in the vertical column only.
e. Mine and secondary output plus imports minus exports.

Unlike the practice in the preceding 7 years, a large share of the investment is to be apportioned to the construction of large enterprises -- for example, open-pit mining is to become a greater proportion of total mining, and the scale of mining at existing underground mines is to be increased greatly. In addition, the recovery of rare and dispersed metals from byproducts is to be increased. 136/ These measures are intended to result in a reduction of 13 to 20 percent in the capital investment required per ton of capacity that is to be added during the period. 137/

2. Cost

The cost of producing lead in the USSR appears to have declined in recent years. In 1955 a Soviet survey of the industry indicated that the cost of producing lead at the three largest plants averaged about 6,800 rubles per ton. Three years later the USSR announced that the cost of producing aluminum was 35 percent less than that of lead. 138/ Inasmuch as the cost of producing aluminum in 1958 was about 4,000 rubles per ton, 139/ the cost of producing lead in 1958 is calculated to have been about 6,200 rubles per ton. By the end of the Seven Year Plan the USSR hopes to reduce the cost of producing lead by 15 percent, which, if achieved, would bring the cost down to about 5,300 rubles per ton by 1965.

[redacted] the cost of 1 ton of lead in ingot form is distributed among the major processes of production as follows 140/: 50X1

Process	Percent of Total*
Mining	40 to 50
Concentrating	17 to 25
Metallurgical reduction	15 to 25
Total	100

Because mining accounts for such a large share of the total cost of producing lead, economies in this sector could be effective in reducing the total cost. The cost of mining 1 ton of ore by the open-pit method in 1957 is estimated to have been about one-half that of mining 1 ton by the underground method. Consequently, as the proportion

* An unexplained aspect of this breakdown is that the only way 100 percent of cost can be reached is to use the upper limit of the range for each process.

of ore mined by the open-pit method becomes larger, significant reductions in the final cost of lead metal may result. Increased mechanization and automation have already contributed to more efficient mining and therefore to reductions in cost. The effectiveness of increased mechanization has been exemplified in improved, more productive drilling machines, 141/ and considerable success in automation has been achieved in stationary mine operations such as drainage of water, ventilation, central heating, and air compression. Automation has been hindered, however, by a lack of standardized automating equipment, and the practice of automating one process without automating its ancillary processes has often resulted in little or no gain in efficiency. 142/

Other than the percentage range of total cost shown above, specific data on costs in the concentrating sector are not available. As in the mining sector, plans have been made for reducing costs of concentrating. Among the improvements to be made during the Seven Year Plan are the following: reducing metal losses in the concentrating process; reducing the consumption of reagents by upgrading ore by heavy media separation before flotation; developing better reagents 143/; decreasing the idle time of the concentrating plants themselves 144/; and extending mechanization and automation into such processes as crushing, sorting, loading, and sampling. 145/

In the metallurgical sector, which normally includes roasting, smelting, and refining, improvements directed toward reducing costs also are being made. Specific examples are the use of oxygen-enriched air in furnaces 146/; the installation of larger refining kettles 147/; the conversion from liquid fuel to electricity 148/; and the automation of dust recovery, decoppering, 149/ and casting. 150/

3. Price

The internal prices for primary lead metal in ingot form were nearly doubled by the changes in the Soviet price structure that took place in the mid-1950's. The official prices of lead of varying degrees of purity before and after the reevaluation are shown in Table 14.* Although the rise in prices was associated with a small upgrading in the GOST standards for primary refined lead metal, the main reason for the increase was to bring prices into better alignment with costs. As shown above, the average cost of production per ton of lead was about 6,800 rubles in 1955. Therefore, before the revision of prices in that year, production of lead must have been subsidized.

* Table 14 follows on p. 42.

Table 14

Prices (1950 and 1955) and GOST a/ Standards (1947 and 1956) for Primary Refined Lead in the USSR

	As of 1 January 1950 b/		As of 1 July 1955 c/	
Mark	Lead Content (Percent) (GOST 3778-47) d/	Rubles per Metric Ton	Lead Content (Percent) (GOST 3778-56) e/	Rubles per Metric Ton
SV	99.992	4,400	N.A.	7,370
S0	99.99	4,170	99.992	7,370
S1	99.98	4,100	99.985	7,150
S2	99.92	3,650	99.95	7,150
S3	99.86	3,400	99.9	7,000
S4	99.5	3,280	99.6	7,000

a. For a definition of GOST standards, see the second footnote on p. 15, above.
b. 151/
c. 152/
d. 153/
e. 154/

B. East Germany

The only other country in the Bloc for which data on capital investment are available is East Germany. Reported investments in production of lead* during 1951-55 and planned investments in the Second Five Year Plan (which was abandoned) are shown in Table 15.** The entire nonferrous industry in East Germany has been plagued since World War II by the government's failure to supply allocated investments. The new lead refinery at Freiberg was actually under construction in 1953 when investment funds were withdrawn.

Although the lead industry of the USSR apparently has not been subsidized since 1955, the lead industry of East Germany may still be subsidized heavily. For example, in 1953 the cost of production of 1 ton of lead metal in East Germany was 2,055 DME,*** 155/ whereas

* It is not known whether these investments were to be allocated to both primary and secondary or only to primary production.
** Table 15 follows on p. 43.
*** Deutsche Mark East (East German marks).

the price was only 600 DME. 156/ By 1955 the price had risen to 707 DME. 157/

Table 15

Capital Investment in the Lead Industry of East Germany a/
1951-55 and 1956-60 Plan

Million Current DME

Year	Mining	Smelting	Total
1951	N.A.	N.A.	16
1952	N.A.	N.A.	28
1953	N.A.	N.A.	32
1954	N.A.	N.A.	8
1955	N.A.	N.A.	7
1956 (Plan)	35	12	47
1957 (Plan)	35	8	43
1958 (Plan)	40	10	50
1959 (Plan)	30	8	38
1960 (Plan)	25	6	31

a. 158/

APPENDIX A

MAJOR FACILITIES FOR MINING AND CONCENTRATING LEAD ORE IN THE SINO-SOVIET BLOC, 1960

Location	Concentrating Plants	Supporting Mines	Remarks
USSR			
Region IV.* Southeast			
Severo-Osetinskaya ASSR	Mizurskiy	Buron Sadon Verkhniy	This plant uses collective flotation to produce lead and zinc concentrates which are sent to the Elektrotsink plant. 159/ The average lead content of the polymetallic sulfide ore ranges between 1.3 160/ and 4.3 percent. 161/ The ore is mined by underground methods. 162/ Complex mechanization is to be completed by 1962.
Region V. Transcaucasus			
Georgian SSR	Kvaisi Tkvarcheli	Kvaisi Madneuli**	These plants use flotation to produce lead and zinc concentrates which are sent to the Elektrotsink plant. 163/ Although the ore is mined by complicated and expensive underground methods, 164/ these operations are to be expanded. 165/
Region IX. West Siberia	Salair	Salair	This plant produces lead, zinc, and barite concentrates. 166/ Polymetallic sulfide ore 167/ is mined by underground methods. 168/

50X1 50X1 50X1 50X1 50X1

50X1

** . The mines probably are located near the concentrating plants that they support.

50X1

Location	Concentrating Plants	Supporting Mines	Remarks
USSR (Continued)			
Region Xa. Kazakhstan			
Alma-Atinskaya Oblast			
Tekeli Combine	Kok-su Tekeli -- three plants	Kok-su Tekeli	This combine produces lead and zinc concentrates 169/ by the flotation method. Lead concentrate is shipped primarily to the Chimkent Lead Plant. 170/ Mining of polymetallic sulfide ore 171/ is conducted primarily by underground methods, 172/ but recently cheaper open-pit mining has been initiated. 173/
Vostochno-Kazakhstanskaya Oblast			
Irtysh Combine at Glubokoye	Belousovka Berezovka	Belousovka Berezovka Glubochansk	This combine produces lead, zinc, and copper concentrates by the flotation method 174/ and also produces blister copper. 175/ The lead concentrate is sent to the Leninogorsk Lead Plant. 176/ Mining of polymetallic ore 177/ with lead content of about 2 percent 178/ is conducted by underground methods. 179/
Leninogorsk Combine	Leninogorsk -- three plants	Andreyevskiy* Bystrukha Leninogorsk Nikolayevsk Skipovaya*	This combine produces lead and zinc concentrates as well as crude lead. Mining of polymetallic 180/ sulfide and oxide ores is conducted both by underground 181/ and open-pit methods. 182/ Underground mining is complicated by a severe water drainage problem. The Leninogorsk mine is the largest nonferrous mine in Kazakhstan 183/; by 1965, however, it will be rivaled by the Nikolayevsk mine, 184/ which is now under construction. 185/ During the Seven Year Plan, the combine is to be modernized 186/ (more fully automated and mechanized) and expanded.

* The mines probably are located near the plants that they support.

Location	Concentrating Plants	Supporting Mines	Remarks
USSR			
Region Xa. Kazakhstan			
Vostochno-Kazakhstanskaya Oblast (Continued)			
Zyryanovsk Combine	Zyryanovsk -- two plants	Grekhovsk* Maslyansk* Zyryanovsk	This combine produces lead, zinc, copper, and pyrite concentrates 187/ by the collective flotation method, 188/ which has been augmented recently by the heavy media separation method. 189/ Lead and zinc concentrates are shipped to the Ust'-Kamenogorsk Combine. 190/ Polymetallic sulfide ore, 191/ containing about 2 percent lead, 192/ is mined by the underground mining method, 193/ which is complicated by severe drainage problems. 194/ During the Seven Year Plan, one additional concentrating plant and an open-pit mine 195/ are to be constructed.
Yuzhno-Kazakhstanskaya Oblast			
Achisay Combine	Achisay Kentau Mirgalimsay	Achisay Glubokaya* Mirgalimsay Tipovaya* Vostochno-Mirgalimsay* Zapadnaya*	This combine produces lead and zinc concentrates. 196/ The lead concentrate is sent to the Chimkent Lead Plant. 197/ Polymetallic sulfide 198/ and oxide 199/ ores are mined by underground methods, which are complicated by subterranean water difficulties. During the Seven Year Plan, the combine is to be modernized and expanded, 200/ and another concentrating plant 201/ and several mines, 202/ mostly open pit, 203/ are to be built.
Region Xb. Central Asia			
Kirgiz SSR			
Kirgiz Combine	Aktyuz Kant	Ak-kul' Aktyuz Buurdin* Kant (Kanskiy) Sumsar	This combine uses the flotation method to produce lead concentrate 204/ which is sent to the Chimkent Lead Plant. 205/ Complex ore, 206/ fairly rich in lead, is mined by both open-pit 207/ and underground 208/ methods, with the open-pit method becoming increasingly important. 209/ During the Seven Year Plan at

50X1

50X1

50X1

50X1

50X1

50X1

* The mines probably are located near the plants that they support.

Location	Concentrating Plants	Supporting Mines	Remarks
USSR			
Region Xb. Central Asia			
Kirgiz SSR			
Kirgiz Combine (Continued)			least one additional concentrating plant will be built, 210/ and the capacity of the others will be increased. 211/
Tadzhik SSR			
Kansay Combine	Kansay Karamazar	Chernaya Gora* Kanimansur* Kansay Kapital'naya* Karamazar Karatan' katan* Tary-Ekam Zambar*	This combine produces lead concentrate for the Chimkent Lead Plant 212/ by the flotation method. 213/ Mining is conducted by underground methods. 214/ A concentrating plant is to be built at Chernaya Gora. 215/
Uzbek SSR			
Altyn-Topkan Combine	Altyn-Topkan Kumyshkansk*	Altyn-Topkan Kumyshkansk Kurgashim	This combine produces lead and zinc concentrates 216/ by the flotation method, 217/ which is supplemented by heavy media separation. 218/ Until a lead metal plant is built at this location, the lead concentrate will continue to be sent to the Chimkent Lead Plant. 219/ The mining of sulfide and oxide ores, some of which are very rich, is conducted by both underground 220/ and open-pit methods, 221/ with the open-pit method becoming increasingly important. When it is in full operation, this combine will supply as much as 20 percent of Soviet lead plant requirements. 222/

50X1

50X1

50X1

50X1

* The mines probably are located near the plants that they support.

Location	Concentrating Plants	Supporting Mines	Remarks	
USSR (Continued)				
Region XI. East Siberia				
Chitinskaya Oblast				
Nerchinsk Administration	Blagodatsk (probably [redacted] Kadaya (probably [redacted] Klichka [redacted]	Blagodatsk Kadaya Klichka	This administration produces lead and zinc concentrates which are shipped to the Urals and the European USSR. 223/ The sulfide ores contain less than 1 percent lead. 224/ The capacity of several plants and mines is to be increased. 225/	50X1 50X1 50X1
Region XII. Far East				
Primorskiy Kray				
Sikhote-Alin Combine at Tetyukhe [redacted]	Sikhote-Alin Primorskaya*	I Sovetskiy* II Sovetskiy* III Sovetskiy* Verkhniy*	This combine produces lead, zinc, and tin concentrates 226/ by the flotation method. 227/ A high-speed flotation method is replacing selective flotation. 228/ Lead concentrate is supplied to the Tetyukhe Lead Plant. 229/ Polymetallic sulfide ores 230/ are mined primarily by underground methods 231/; recently, however, open-pit mining has been initiated. 232/	50X1

* [redacted] The mines probably are located near the plants that they support. 50X1

Location	Concentrating Plants	Supporting Mines	Remarks
European Satellites*			
Bulgaria 233/			
Rhodope Mining Basin	Kurdzhali Madan Rovina Rudozem Srednogortsi Tursko Pole	Boreiva En'ovche Fabrika Gyudyurska Konsky del Krushev dol Madan Petrovitsa Ribnitsa Rovina Rudozem Sherenka Tursko Pole	These plants now produce or are to produce lead and zinc concentrates. The total annual capacity of the first five plants now in operation is about 2.7 million tons of ore, about 70 percent of which is accounted for by the Rudozem Plant. The polymetallic ore mined in 1958 contained 3.6 percent lead. The Tursko Pole Plant was under construction in 1959 and is to have an annual ore capacity of nearly 400,000 tons. 50X1 50X1 50X1
North Central Rhodope Mountains	Asenovgrad	Asenovgrad	This plant was under construction in 1959 and is to produce lead and zinc concentrates at an annual ore capacity of nearly 400,000 tons. This will be called the Northern Rhodope Center. 50X1
West Balkan Mountains	Chiprovtsi	Chiprovtsi	This plant produces lead concentrate at an annual ore capacity of 200,000 tons. 50X1
Yambol Okrug	Ustrem	Lesovo Ustrem	This plant produces lead concentrate at an annual ore capacity of 200,000 tons. 50X1
Poland 234/			
Bytom area	At three of the mines	Marchlewski** Nowy Dwor** Orzel Bialy** Warynski**	These plants produce lead and zinc concentrate by the flotation method. The polymetallic ore mined here contains lead in both sulfide and oxide forms. 50X1

* Albania, Czechoslovakia, East Germany, Hungary, and Rumania are omitted from this appendix because of the insignificance of their mining and concentrating operations.

** The mines probably are located near the plants that they support. 50X1

Location	Concentrating Plants	Supporting Mines	Remarks
European Satellites			
Poland (Continued)			
Miasteczko Combine	Miasteczko	Miasteczko	This combine is to produce lead and zinc concentrates, as well as metal, from oxide ore. The combine is to be built in the early 1960's and is to be in full operation by 1966. 50X1
Olkusz-Chrzanow area	Boleslaw Trzebionka	Boleslaw Jaworzno Olkusz Trzebionka	The Boleslaw plant produces lead and zinc concentrates by the flotation method from sulfide and oxide ores produced at the Boleslaw and Jaworzno mines. A plant is to be built near Trzebionka that will concentrate the ore output of the Olkusz and Trzebionka mines, which are scheduled to go into full operation by 1965. 50X1 50X1
Asian Bloc			
Communist China			
Hunan Province	Shui-k'ou-shan T'ao-lin	Shui-k'ou-shan T'ao-lin	These plants produce lead and zinc concentrates. The Shui-k'ou-shan mine is old and has been expanded and modernized with Soviet aid 235/ until it is probably the largest single mine in China. 236/ The second mine is new and large. 50X1 50X1
Kiangsi Province	Ch'ien-shan	Ch'ien-shan	This plant produces lead concentrate from a new, modern, and relatively large mine. 50X1
Kwangsi Autonomous Region	Sze-ting*	Sze-ting	This plant produces lead and zinc concentrates from a new, modern, and relatively large mine developed with Bulgarian aid. 237/
Kwangtung Province	Lien-hsien	Lien-hsien	This plant produces lead concentrate from a new, modern, and relatively large mine. 50X1

* The mines probably are located near the plants that they support. 50X1

Location	Concentrating Plants	Supporting Mines	Remarks
Asian Bloc			
Communist China (Continued)			
Manchuria, Kirin Province	T'ien-pao-shan	T'ien-pao-shan	This plant produces lead and zinc concentrates from a mine which existed in the pre-Communist era.
Manchuria, Liaoning Province	Ch'ing-ch'eng-tsu Hsiu-yen Yang-chia-chang-tzu	Ch'ing-ch'eng-tsu Hsiu-yan Yang-chia-chang-tzu	These plants produce lead and zinc concentrates from mines which existed in the pre-Communist era.
Tsinghai Province	Hsia-pu-leng (Tsaidam Basin)*	Hsia-pu-leng	This plant produces lead and zinc concentrates from a new, modern, and relatively large mine which, upon completion, is to be the largest lead and zinc mine in China. 238/
Yunnan Province	K'wang-shan-ch'ang Lao-chang Lo-p'ing	K'wang-shan-ch'ang Lao-chang Lo-p'ing	These plants produce lead and zinc concentrates. The K'wang-shan-ch'ang mine existed in the pre-Communist era. The other two mines, which are new, modern, and relatively large, have been developed with Soviet aid. 239/
North Korea			
Chagang-do Province	Kyesaeng* Yongun*	Kyesaeng Yongun	Both plants produce lead concentrate, 240/ and the Kyesaeng plant, which is subordinate to the Lead Mining Administration Bureau,** 241/ also produces zinc concentrate. 242/ Both are Class II mines.***

* The mines probably are located near the plants that they support.

** The Lead Mining Administration Bureau is one of five branches of the Ministry of the Metals Industry.

*** The class of a mine apparently is related directly to the number of employees; the fewer the number of employees in the mine, the higher is the number of its class.

Location	Concentrating Plants	Supporting Mines	Remarks
Asian Bloc			
North Korea (Continued)			
Hamgyong-namdo Province	Ch'onnam Komdok Sangok	Ch'onnam Komdok Sangok	The underground plant at Komdok produces lead and zinc concentrates; the Ch'onnam and Sangok plants probably produce the same. 243/ The Ch'onnam and Sangok plants, which are subordinate to the Lead Bureau, 244/ are Class III mines. 245/ The Komdok plant, a Class I mine employing 5,000 workers, 246/ is the largest mine in North Korea. 247/ All three plants mine zinc primarily but also produce lead in both sulfide and oxide ores.
Hwanghae-pukto Province	Holtong*	Holtong	This plant, which is subordinate to the Lead Bureau, produces lead and zinc concentrates from the ore of Class III Holtong mine. 248/
Hwanghae-namdo Province	Nagyon Ongjin	Nagyon Ongjin	The Nagyon plant, which is subordinate to the Lead Bureau, 249/ probably produces lead concentrate, and the Ongjin plant probably produces both lead and zinc concentrates. Both are Class II mines. 250/
P'yongan-pukto Province	Ch'onma Mullye* Songch'on	Ch'onma Mullye Songch'on	The Mullye and Songch'on Plants, and probably also the Ch'onma Plant, produce lead and zinc concentrates. 251/ The Ch'onma and Mullye plants are subordinate to the Lead Bureau 252/ and have Class III mines. 253/ The Songch'on plant is not known to be subordinate to the Lead Bureau and has a Class II mine. 254/
P'yongan-namdo Province	Taeyu-dong	Taeyu-dong	This plant probably produces lead concentrate from the ore of its Class II mine. 255/ This ore also contains precious metals.

* The mines probably are located near the plants that they support.

50X1

APPENDIX B

PRIMARY LEAD SMELTERS AND REFINERIES IN THE SINO-SOVIET BLOC, 1960

Location and Name	Estimated Capacity* (Thousand Metric Tons)	Remarks
USSR		
Region IV. Southeast		
Severo-Osetinskaya ASSR		
Elektrotsink at Ordzhonikidze	25 256/	This plant, which was operating before the Bolshevik Revolution, produces crude and refined lead, 257/ electrolytic zinc, 258/ rare 259/ and precious metals, 260/ and sulfuric acid. 261/ It was reconstructed in 1948, 262/ and has agglomerating, smelting, and refining facilities. It was planned in 1958 to become the pilot plant for the complete recovery of useful components and for full automation of all production stages. 263/ The principal suppliers of concentrate for this plant are the Kvaisi, 264/ Leninogorsk, 265/ and Mizurskiy 266/ Concentrating Plants. Production of lead at this plant in 1965 is planned to be 1.5 times the level of 1957. 267/
Region Xa. Kazakhstan		
Vostochno-Kazakhstanskaya Oblast		
Leninogorsk	70 (crude**)	This plant produces both crude lead 268/ and rare 269/ and precious 270/ metals. In the early Soviet period a plant at this location was called Ridder. 271/ The plant was reconstructed in 1940, 272/ and the industrial reorganization of July 1957 improved its raw material base. 273/ The plant has agglomerating and smelting facilities, but its refining facilities apparently have been dismantled since 1956. 274/ The principal suppliers of concentrate to this plant are the Belousovka, 275/ Berezovka, 276/ and Leninogorsk 277/ Concentrating Plants, and the Nikolayevsk Concentrating Plant, now under construction, may become a future supplier. 278/ During the Seven Year Plan, lead production is to be increased considerably by means of reconstruction 279/; electrothermic smelting, now conducted on an experimental scale, is to be introduced on industrial scale 280/; and a slag fuming installation is to be built. 281/

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* Refined output unless otherwise indicated.
** See III, A, 1, c, p. 13, above.

Location and Name	Estimated Capacity (Thousand Metric Tons)	Remarks
USSR		
Region Xa. Kazakhstan		
Vostochno-Kazakhstanskaya Oblast (Continued)		
Ust'-Kamenogorsk	100 (crude) 170	This plant produces crude and refined lead, 282/ electrolytic zinc, 283/ blister 284/ and matte copper, 285/ rare 286/ and precious 287/ metals, and sulfuric acid. 288/ The lead plant went into operation in 1952, 289/ and has agglomerating, smelting, and refining facilities. In 1956 the plant took over the refining of the crude lead output of Leninogorsk 290/ and began operating the first slag fuming installation in the USSR. 291/ In 1957 it was termed the "best equipped" plant in the USSR. 292/ In 1958, plans for the reconstruction of the lead plant were being worked out. 293/ Principal suppliers of concentrate to this plant are the Tekeli 294/ and Zolotukha 295/ Concentrating Plants and the Zyryanovsk Lead Combine, 296/ and the Alagir 297/ and Karagayly 298/ Concentrating Plants, now under construction, may be future suppliers. During the Seven Year Plan this plant is to be made into an experimental enterprise which will be the model for complex mechanization and automation of all production processes, 299/ and it is to increase its production of refined lead to 125.5 percent of the level of 1958. 300/
Yuzhno-Kazakhstanskaya Oblast		
Chimkent	70	This plant produces crude and refined lead 301/ and rare 302/ and precious 303/ metals. It was built in the Soviet era 304/ and was reconstructed during the Fifth Five Year Plan 305/ and the initial years of the now-abandoned Sixth Five Year Plan. 306/ The plant has agglomerating, smelting, and refining facilities, and liquid alkaline refining was introduced in 1955. 307/ In 1958, it had the first and only vacuum dezincing installation in the USSR. 308/ Principal suppliers of concentrate are the Achisay 309/ and Kansay 310/ Polymetallic Combines, the Altyn-Topkan 311/ and Tekeli 312/ Lead-Zinc Combines, and the Kirgiz Concentrating Combine. 313/ During the Seven Year Plan a slag fuming installation is to be installed 314/ and production of lead is to be increased to 1.3 times the level of 1958. 315/

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Location and Name	Estimated Capacity (Thousand Metric Tons)	Remarks	
USSR (Continued)			
Region XII. Far East			
Primorskiy Kray			
Tetyukhe at Tetyukhe-Pristan'	55	This plant produces crude and refined lead 316/ and also silver. 317/ It was put into operation during the Soviet era 318/ and is the metal-producing sector of the Sikhote-Alin Polymetallic Combine. 319/ The plant has smelting and refining facilities and processes rich concentrate which probably is not agglomerated. The principal suppliers of concentrate are the Primorskaya 320/ and the Sikhote-Alin 321/ Concentrating Plants. No expansion plans have been announced.	50X1
European Satellites*			
Bulgaria 322/			
Kurdzhali	30	This plant, which produces crude and refined lead and zinc, was constructed in 1955 with Soviet aid.	50X1
Kurilo	10 (15 planned for 1965)	This plant produces crude and refined lead and was constructed in the early 1940's.	50X1
Plovdiv	(40 planned for 1961 or 1962)	This plant will produce crude and refined lead and zinc. It was under construction in 1959, and machinery and equipment as well as needed specialists are planned to be supplied by the USSR.	
Czechoslovakia 323/			
Banska Stiavnica	5	This plant produces crude and refined lead.	50X1
Pribram	10	This plant produces crude and refined lead.	50X1
East Germany 324/			
Muldenhuette at Freiberg	5	This plant, which produces crude and refined lead, was joined administratively in 1956 with Freiberg Bleihuette, thus forming VEB Freiberger Bleihuetten.	50X1

* Albania has no facility for producing lead, and production of lead in Hungary is negligible.

Location and Name	Estimated Capacity (Thousand Metric Tons)	Remarks
European Satellites (Continued)		
East Germany (Continued)		
Freiberg Bleihuette at Halsbrucke	3	This plant specializes in the recovery of rare and precious metals and produces crude and refined lead almost as a byproduct. The lead, which has been refined by oxidized smelting, is further refined electrolytically. The plant was joined administratively in 1956 with Muldenhuette, thus forming VEB Freiberger Bleihuetten. The plant is antiquated and is not considered worth modernizing, although some equipment has been replaced recently.
Bleihuette at Hettstedt	4	This plant, which produces crude and refined lead, was built in 1810 and is the oldest part of VEB Mansfeld-Huetten Kombinat Wilhelm Pieck at Eisleben. It processes lead concentrates produced from copper ores into electrolytic lead and lead alloys. Complete reconstruction is to be accomplished during 1961-63; equipment is to be installed in a new plant for processing flue dust from copper smelters, and production of rare metals is planned.
Poland 325/		
Boleslaw	6	This modern plant produces crude and refined lead and zinc. Some of its crude output is refined at Szopienice.
Orzel Bialy at Brzeziny	5	This plant, which produces crude lead and zinc, supplies crude lead to the Szopienice Refinery but also accounts for about one-eighth of the total refined output of Poland.*
Miasteczko	Under construction	This plant is to produce crude and refined lead and zinc from oxide ore. Construction is scheduled to start in 1961; the plant is to be commissioned in 1964 and to be working at full capacity in 1966.
Warynski at Piekary Slaski	5	This plant, which produces crude lead and zinc, supplies crude lead to the Szopienice Refinery but also accounts for about one-eighth of the total refined output of Poland.*
Szopienice	23	This plant, which produces refined lead, zinc, and copper and rare and precious metals, is the largest nonferrous works in Poland. It receives crude lead from three smelters and accounts for nearly 60 percent of the country's output of refined lead.

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* Some of Poland's output of crude lead is not refined but is included in the total refined output.

Location and Name	Estimated Capacity (Thousand Metric Tons)	Remarks
European Satellites (Continued)		
Rumania 326/		
Georghiu-Dej at Baia-Mare	6	This plant produces crude and refined lead, copper, and precious metals. The largest nonferrous works in Rumania, formerly called Phoenix, it was built before World War II and enlarged under the Communist regime. In 1943 it had an annual capacity of 5,000 tons of crude and 3,000 tons of refined lead.
1 Mai at Firiza	10	Before World War II this plant, which produces crude and refined lead and blister copper, was the chief lead smelter in Rumania. Its capacity has been increased since 1951.
Georghe Doja at Zlatna	4 (crude)	This plant produces crude lead and blister copper.
Asian Bloc		
Communist China 327/		
Hunan Province		
Chu-chou	5	This plant produces crude and refined lead and zinc. It is a new plant; construction was to have been completed by 1960.
Shui-k'ou-shan	15	This plant existed in the pre-Communist era, but its capacity was expanded in 1950-55. It produces crude and refined lead and zinc.
Kwangtung Province		
Shao-kuan	60	This plant, which produces crude and refined lead, zinc, and copper, is the largest of its kind in Communist China. It was reported to be under construction in 1958. Its planned production for 1959 was 20,000 tons and for 1960, 60,000 tons.
Manchuria, Liaoning Province		
Mukden (Shen-yang)	20	This plant, which produces crude and refined lead, is the largest of the pre-Communist smelting and refining plants and was restored and in operation by 1950. 328/

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Location and Name	Estimated Capacity (Thousand Metric Tons)	Remarks
Asian Bloc		
Communist China (Continued)		
Yunnan Province		
Ko-chiu [redacted]	10 329/	This is a new plant, in operation at least by 1957, 330/ which produces both crude and refined lead.
North Korea 331/		
Munp'yong [redacted]	27	This plant produces crude and refined lead, electrolytic zinc, and rare and precious metals. Since 1956 it has been processing some domestically produced oxide ores, a demonstration of significant technological ability.
Total refined capacity	579	

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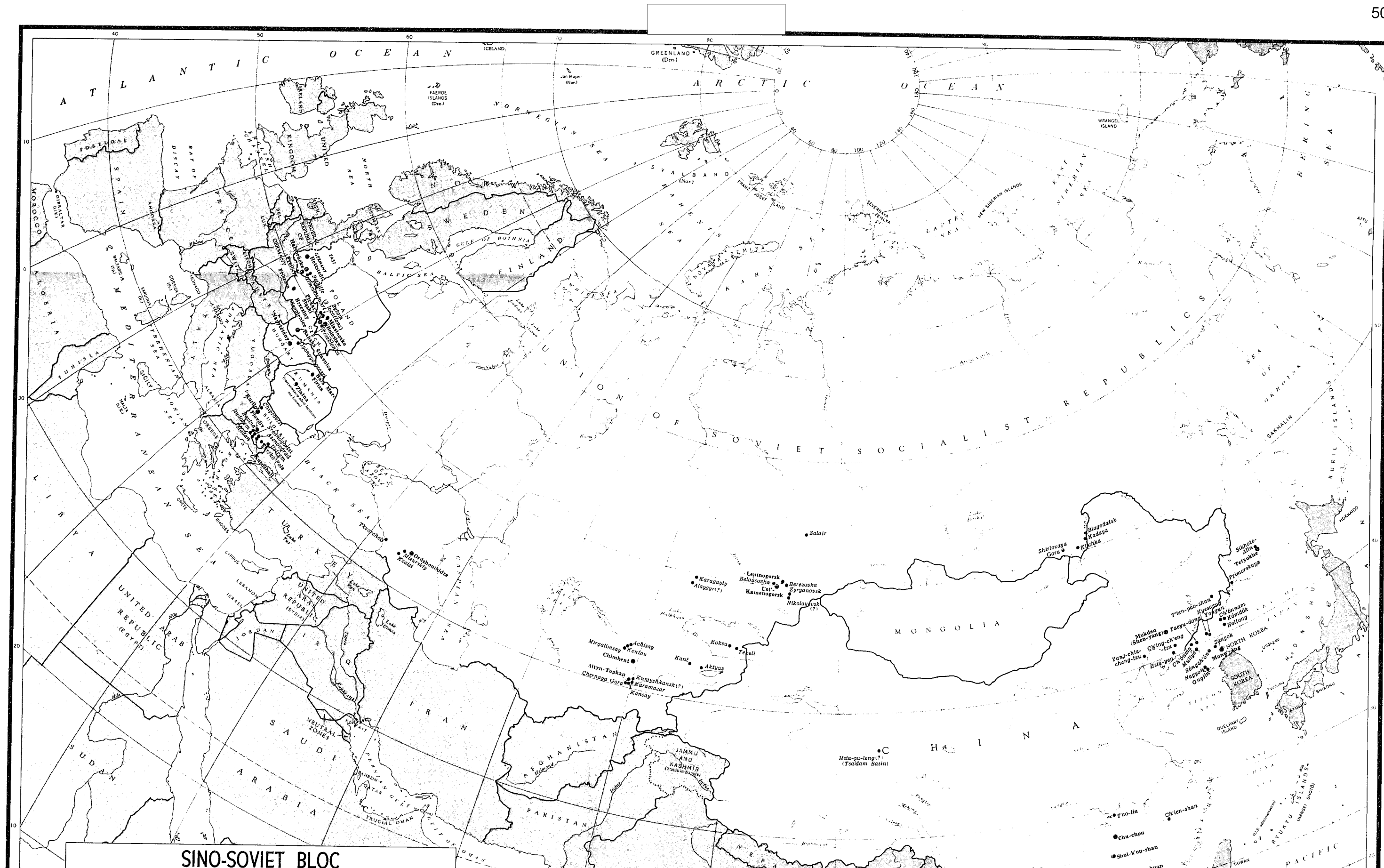

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